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Phonological Features and Morphological Structure

John J. McCarthy

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"What sort of language do you consider French, sir?"

"How do you mean?" asked Nicholas.

"Do you consider it a good language, sir?" said the Collector; "a pretty language, a sensible language?"

"A pretty language, certainly," replied Nicholas; "and as it has a name for everything, and admits of elegant conversation about everything, I perceive it is a sensible one."

"I don't know," said Mr. Lillyvick, doubtfully. "Do you call it a cheerful language, now?"

"Yes," replied Nicholas, "I should say it was, certainly."

"What's the water in French, sir?"

"*L'Eau*," replied Nicholas.

"Ah!" said Mr. Lillyvick, shaking his head mournfully, "I thought as much. Lo, eh? I don't think anything of that language -- nothing at all."

Nicholas Nickleby

1. Introduction

Certain aspects of morphological structure have always received very close attention; these include suffixation, prefixation, and compounding.¹ Such purely concatenative morphological mechanisms seem to be very well understood, and so there are subtle and complex theories to account in considerable detail for morphological properties of a concatenating language like English. Other kinds of morphological structure have for their part been partly neglected: root-and-pattern morphology, reduplication, infixation, suprafixation, vowel and consonant symbolism, and formation of ideophones, to name a few. This neglect presumably stems from the exotic character of these nonconcatenative morphological phenomena -- they are hardly met with in the familiar European languages, except in a few paralinguistic situations like language games and such. Yet these exotic phenomena pervade the world's languages with a regularity and complexity that makes them both essential and ideal for testing any theory of morphology. Morphological analyses or theories that are limited to the familiar concatenative behavior of the well-studied European languages are at best incomplete and at worst misleading in the light of the much richer morphological possibilities of the world's languages.

Of special interest is one particular variety of nonconcatenative morphology. Taken as a class these phenomena lack any single name or popular designation in the literature, but they all share some essential characteristic properties to the exclusion of virtually all other types of morphology. These morphological operations systematically change the phonetic makeup of a stem without adding or removing segments. Typically, they behave in a quasi-phonological fashion but clearly have a function in the lexicon that is on a parallel with that of other,

purely affixational morphology. Following Lieber (1982, forthcoming), I will refer to this sort of morphology by the convenient pretheoretical designation *mutation*, though it should be understood that this accords no special status to the Celtic phenomenon from which this term is drawn.

The diagnostic property of mutation in the sense used here is morphologically-governed alternation in the phonetic form of some (partially) phonetically-defined set of segments in a word. The requirement of morphological government is taken to mean that a mutation must evoke a systematic difference in meaning (which may in many cases be in an essentially iconic relation with the mutation). This is to be distinguished from the weaker sense of morphological government appropriate to rules of allomorphy. Rules of allomorphy must be triggered by the presence of some other morpheme (Aronoff 1976, Lieber 1980), whereas mutation is not triggered -- its alternations are not contingent on the presence of some other morpheme. Mutation may be the etymological residue of some general phonological process, as is the case with the eponymous Celtic phenomenon, but it may also have only a purely morphological history as far as we can reconstruct.

Understood in this sense, mutation is a common phenomenon in many of the less familiar languages. There are quite a number of different processes that, in some instances, come under this general rubric:

- true consonant mutation or vocalic Ablaut.
- systems of ideophones.
- consonant symbolism or vowel symbolism.
- echo-word derivation.

In this paper I will analyze examples of some of these phenomena, concentrating particularly on certain cases where the quality of vowels or consonants is determined throughout a word by morphological mechanisms. I first present an autosegmental theory of morphology that correctly characterizes many aspects of this global (that is, word-level) segment quality morphology. The specific illustrations selected here all exemplify aspects of this theory in action. They include ideophone formation in Korean, the derivation of echo-words in the South Munda language Gta?, an unusual sort of reduplication in the Chinese Hengxian dialect, and the creation of iteratives in Jamaican Creole.

Some disclaimers. I make no attempt here to present an exhaustive account of all nonconcatenative morphological phenomena, or even of those general types listed above. Under constraints of space and time both the examples and the theoretical framework have been simplified and some less important distinctions have been suppressed. Some issues have been completely neglected here -- notable examples are the rich variety of consonant symbolism systems in northwestern North America or the vowel and consonant mutations in the inflectional systems of Nilotic languages. Fuller development of many of these points appears in McCarthy (forthcoming).

Many of the examples I discuss here may be subsumed under the general designation of sound symbolism because they make phonetic distinctions that stand in an essentially iconic relationship with their meaning. My concern is entirely with the formal properties of these systems -- what sorts of segments they affect, what phonetic properties they exploit, and how they might apply throughout a word. Thus, I have nothing to say about the issue of iconic versus symbolic meaning nor have I attempted to review here the extensive literature on this topic.

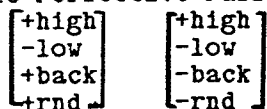
2. Theoretical Background

The classic item-and-arrangement model of morphological description has usually been predicated on a particularly restrictive definition of morphemes, the fundamental analytic units of morphology. Under this definition, a morpheme is a string of one or more segments with constant meaning. Word formation then consists of simple concatenation of morphemes into higher level strings of segments.

From recent research (Broselow 1983; Halle and Vergnaud 1981, forthcoming; Lieber 1982, forthcoming; Marantz 1982; McCarthy 1979, 1981, 1982, forthcoming; Yip 1982) has emerged a new theory of morphology that is designed around the problems of nonconcatenative morphological phenomena. Two aspects of this new theory are particularly relevant to the problem of mutation, and so they will be the focus of our attention here. First, the definition of morpheme is weakened from that of the classical I-A theory to allow a morpheme to consist of a matrix of one or more distinctive features or of a string of such underspecified feature matrices. That is, a morpheme can consist of as little as a single phonological distinctive feature, while morphemes composed of segments (as in the familiar languages) are a special case in which the feature bundles happen to be fully specified. Second, word formation is generalized from simple concatenation of morphemes to the assembly of forms by the association procedures of autosegmental phonology. The feature-sized morphemes receive surface phonetic expression through their autosegmental association with other morphological units that go into making up the fully-specified utterance.

This theory was originally developed in connection with the morphological system found in the the Semitic languages, a system that heavily exploits morphemes composed of feature matrices that are less than whole segments, a property that I have analyzed in considerable detail elsewhere. (McCarthy 1979, 1981). For example, in Classical Arabic the perfective aspect of the inflectional passive is indicated morphologically by an alternation in the quality of the stem vowels: all nonfinal stem vowels become *u* and the final one becomes *i*. We can characterize this particular mutation phenomenon, which is unintelligible under conventional I-A assumptions, by isolating a perfective passive morpheme composed of the distinctive feature bundles in (1). The lexical representation of a verb stem contains vowels that are unspecified for quality. Word formation consists of associating the feature bundles in (1) with appropriate unspecified vowels in the rest of the phonological representation to yield the result in (2).²

(1) Arabic Perfective Passive Morpheme



tVkVVtVb = *tukuutib*

The morpheme in (1) is made up solely of features for vowel quality; its realization on particular vowels depends on the results of the autosegmental association rules, as in (2). A parallel argument can be made for consonant quality,

permitting us to isolate the traditional Semitic triconsonantal root.

The formation of the perfective passive in Arabic is, of course, a kind of mutation; properly speaking, there is Ablaut between a passive form like *tukuutib* and its corresponding active *takaatab*. But familiarity has perhaps rendered this example less dramatic than it ought to be. Therefore I adduce the following quite compelling case in which the tonal system, an area where autosegmental analysis is relatively clear and uncontroversial, has a mutation phenomenon subject to analysis by feature-sized morphemes.

Excursus

The Nigerian Kwa Language Bini (Wescott 1973) has a tonal distinction that completely dominates the prosody of nearly all adverbs (and, to a lesser extent, nouns, particles, and exclamatives). Words of this lexical category have uniform tone, either high or low, on all syllables. Nearly all have a rigid, apparently iconic, relation between tone and lexical semantics; for 90% of these, high tone means tall, thin, tight, bright, or open versus short, thick, loose, dull, or closed for low tone. Some of Wescott's (1973) many examples appear in (3):²

(3) High-toned Adverbs		Low-toned Adverbs	
a. Tall		Short	
gadagbaa	'long & lanky'	betee	'short & fat'
gidigbii	'big & high'	gieghegieghe	'short'
gbokoo	'tall & portly'	gieenrlen	'small'
gbɔhuun	'tall & fat'	giegiegie	'tiny'
higboo	'tall & fat'	gueerle	'very small'
gegeege	'lofty'	kpekurlu	'short'
geletee	'towering'	kpukurlu	'cringing'
gogoogo	'very high'	woo	'burning low'
b. Bright		Dull	
gieenrlen	'bright & clear'	muen	'faint, dull'
gborlogborlo	'loud & clear'	gbɔɔ	'gaping'
goorlo	'high pitched'		
goghogogho	'high pitched'		
rhanrhaanrhan	'loud'		
rleghee	'loud'		
c. Thin		Thick	
gilɔgilɔ	'tall & slender'	gbankangbankan	'big & thick'
sigosigo	'tall & thin'		
gokaan	'tall & lean'		
gunkaan	'very thin'		
fioghofiogho	'tall & thin'		
rhigoo	'tall & lean'		
rhiamarhiama	'lean'		
vienvieenvien	'small & thin'		
vien'in	'delicate'		
yinghenyinghen	'very lean'		
simosimo	'skinny'		
singensingen	'very thin'		
weenrlen	'narrow'		

d. Tight

kankaankan	'tight'
gbangbaangban	'stiff'
kakaaka	'hard'
kokooko	'hard'
lukuluku	'strong'

Loose

panpaanpan	'slack'
bɔɔɔɔɔ	'fleshy'
guazaguaza	'billowy'
zɛgɛzɛgɛ	'loose, shaky'
lɔgɔlɔgɔ	'loose-jointed'
lɔgɔlɔgɔ	'swaying'
buzɛbuzɛ	'powdery'
waghawagha	'crumbly'

e. Open

gboo	'wide open'
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Closed

kukuuku	'closed'
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Apart from these obvious and pervasive regularities, there are a few really striking examples of direct meaning contrasts based solely on a high/low tonal distinction without corresponding segmental differences:

(4)	High-toned	Low-toned
betɛɛ	'big & fat'	'short & fat'
gunkaan	'emaciated'	'sitting down heavily'
gbodoo	'long & wide'	'full (of the moon)'
gidigbii	'tall'	'husky'
lelelele	'big (corpse)'	'big (yam-stick)'

The issue, then, that is raised by Bini adverbs is one of the use of tonal melodies as morphemes, paralleling the use of vowel quality as a morpheme in the Classical Arabic inflectional system. The interpretation of the formal aspect of this fact in terms of the enriched conception of morphology here is almost self-evident.⁴ Formally we shall say that Bini grammar contains two morphemes consisting solely of tonal information: [+high tone] and [-high tone]. These morphemes are each affiliated with the constellation of meanings appearing above. Uncontroversially, the tonal information about Bini adverbs appears on a separate autosegmental tier and is associated with vowels (or syllables) of the segmental representation by the usual rules of association. In fact, the only association procedure required is the one generally known as spreading, which ensures that the single tonal element is linked to all units of the segmental representation that can bear tone. We see the result in (5):

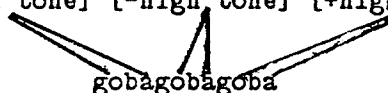


Some independent confirmation for this conception of tonal morphemes in Bini comes from the remaining 10% of Bini iconic adverbs having nonuniform tone. According to Wescott (1973), these adverbs almost invariably have the overall tone pattern high-low-high and refer to "irregular shape or motion" as in (6):

(6) rhúr ^h rhú ^h	'staggering'
per ^l er ^l per ^l er ^l	'fluttering'
tigh ⁱ tigh ⁱ tigh ⁱ	'twisted'
kin ^ɔ kin ^ɔ kin ^ɔ	'woven'
big ^ɔ big ^ɔ big ^ɔ	'crooked'
gób ^a gób ^a gób ^a	'crippled'
khur ^l lukhur ^l lukhur ^l	'jerky'
gher ^l egher ^l egher ^l	'stealthy'
ying ^h eny ^h ying ^h eny ^h	'skimpy'
yeng ^h eny ^h yeng ^h eny ^h	'kinky'

These facts are accounted for by isolating the additional tonal morpheme in (7a), which appears in the representation in (7b). It would seem that the rules of association are sensitive to the reduplicated character of all of these forms, assigning a different level tone to each copy of the basic segmental morpheme:

- (7) a. Bini "Irregular" Morpheme
 [+high tone] [-high tone] [+high tone]
- b. [+high tone] [-high tone] [+high tone]



The grammar of Bini, then, provides for at least three morphemes whose makeup is exclusively tonal. Word formation is accomplished by associating these tonal morphemes with segments, as in (5) and (6), by means of the usual autosegmental apparatus. Morphemes of this sort are uncommon but certainly attested in other tonal systems, as in the case of inflection by tonal melodies in Tiv (Goldsmith 1976). They confirm the overall approach presented here in a striking way.

End of Excursus

There are many aspects of a theory of this sort that need investigation: the nature and kinds of features that can assume morphemic status; the form of the core or basic representation to which the morphemic features are associated; the properties, universal and language-particular, of the association operation itself. Although I believe all of these questions to be both important and answerable, I shall only address them incidentally, as *obiter dicta*, here. Rather, my concern is chiefly with showing the descriptive and explanatory power of this relatively small modification of the item-and-arrangement theory. Thus, my primary object is to display analyses of a variety of phenomena, with the aim of demonstrating the special relevance of features as morphemes and of autosegmental association to the cases discussed here.

3. Exemplification

3.1. Ideophones in Korean

One of the most complex and interesting classes of nonconcatenative or mutating morphological phenomena is the formation of ideophones. Ideophone

systems seem roughly to divide into two types: those with systematic formal properties, which are our concern here, and those without any recognizable formal properties, about which this theory says nothing. Ideophone systems of the first type correspond in a sense to morphology of the conventional sort, while those of the second type correspond only to a lexicon of formally distinct (but semantically related) morphemes. Korean, as we shall see, is of the formally systematic type, displaying a great deal of internal structure with semantic function to its ideophones. Languages of the second type include Shona (Fortune 1962:18) and Zulu (Jones 1981).⁴ It appears in these languages (though such a negative result is necessarily quite tentative) that an ideophone may be any phonotactically permissible sequence of segments, with the actually occurring ideophones showing a normal distribution among all such sequences.

Languages whose ideophones do have considerable internal structure typically implement that structure with amalgamations of feature-sized morphemes. This was first observed by Diffloth (1976), who writes, commenting on the language Semai:

It follows that the "roots" of expressives [a superset of ideophones -- JJM] have to be analyzed into very small "morphemes" -- elements as small, perhaps, as distinctive features. We must be prepared to see the expressive as a whole decomposed in such manner, to discard the conventional notions of root and morphology, and to treat expressives as micro-sentences made up of distinctive features.

(Diffloth 1976:261)

It should be noted that Diffloth goes on to say that such an analysis requires a greater understanding of the meaning of expressives than we now possess and that it might in any case be misguided since the iconicity of expressives distinguishes them from ordinary morphology at least as much as the formal character of the morphemes.

Here I intend to pursue Diffloth's suggestion about the form of the morphemes in ideophones, taking as my basis the autosegmental morphological theory justified on the basis of quite different sorts of phenomena, by examining certain aspects of the ideophone system of Korean.⁵ Various properties of Korean ideophones have been the subject of articles by Kim-Renaud (1976, 1978), Martin (1962), and Diffloth (1972). All my evidence comes from the intuitions of a single speaker, Young-Seok Kim, whose fluid linguistic imagination has been of great assistance to me in this investigation.

Martin (1962) describes three different parameters of internal alternation along which Korean ideophones may vary. One is the laryngeal gestures of a syllable-initial obstruent corresponding to intensity, the second is the height of all stem vowels corresponding roughly to size, and the third is the quality of the stem-final consonant marking a range of classificatory semantic properties.⁶ Here I will concentrate on the first two aspects of Korean ideophone formation, which are amenable to an essentially paradigmatic presentation and relatively straightforward formal analysis. In McCarthy (forthcoming) I deal with the third parameter of Korean ideophone formation as well.

Korean has three types of voiceless stops with distinct laryngeal activity (Kim 1970): stops with nearly simultaneous release and voice onset, transcribed here as *p'*, *t'*, *c'*, and *k'*; stops with relatively short voice onset lag, transcribed as *p*, *t*, *c*, and *k*; and stops with relatively long voice onset lag, transcribed as *p^h*, *t^h*,

c^h , and k^h . There is as well for the only other obstruent a distinction between nearly simultaneous voice onset s' and short voicing lag s , though there is no third member of this opposition. These contrasts are preserved in syllable-initial position only; they are otherwise neutralized. They can be identified phonologically in terms of the Halle and Stevens' (1971) laryngeal feature system as in (8):

(8)	a. voiceless unaspirated	$C' =$	$\begin{bmatrix} +\text{stiff v.c.} \\ -\text{slack v.c.} \\ -\text{spread gl.} \\ -\text{const. gl.} \end{bmatrix}$
	b. lightly aspirated	$C =$	$\begin{bmatrix} -\text{stiff v.c.} \\ -\text{slack v.c.} \\ +\text{spread gl.} \\ -\text{const. gl.} \end{bmatrix}$
	c. heavily aspirated	$C^h =$	$\begin{bmatrix} +\text{stiff v.c.} \\ -\text{slack v.c.} \\ +\text{spread gl.} \\ -\text{const. gl.} \end{bmatrix}$

This phonemic contrast has a direct semantic correlation in the ideophone system. Any obstruent capable of displaying the opposition in (8) (therefore, any syllable initial stop and, partly, the fricative s) can in principle mark a morphological property of ideophones. The lightly aspirated obstruent series has a kind of simple or unmarked character to which the others are opposed. The heavily aspirated series is most intensive (paraintensive) while the unaspirated series is simply intensive. Examples appear in (9):⁸

(9)	Simple	Intensive	Paraintensive
a. round and round; $piŋ\ piŋ$ in circles		$p'iŋ\ p'iŋ$	$p^hiŋ\ p^hiŋ$
b. rumbling, rattling	$t\partial l\ t\partial l$	$t'\partial l\ t'\partial l$	$t^h\partial l\ t^h\partial l$
c. in an undertone, in whispers	$sokon\ sokon$	$s'okon\ s'okon$	
d. with a click or clink	$calkak/$ $calkatak$	$c'alk'ak/$ $c'alk'atak$	$c^halk^hak/$ c^halk^hatak
e. in the dark; uninformed	$kam\ kam$	$k'am\ k'am$	$k^ham\ k^ham$

The nonalternating obstruents in syllable final position in (9) are positionally restricted by independently necessary rules of Korean phonology. The empty cell for $*s^h$ is explained similarly.

The autosegmental theory, by permitting morphemes that are feature-sized, allows a partial decomposition of the forms in (9). We can extract morphemes corresponding to the different laryngeal gestures possible with syllable-initial obstruents. These morphemes, appearing in (10), are composed of the features for unaspirated and for heavily aspirated obstruents in (8), and they bear the intensive and paraintensive meanings respectively:

- (10) a. Intensive Morpheme b. Paraintensive Morpheme

[+stiff v.c.]
[-slack v.c.]
[-spread gl.]
[-const. gl.]

[+stiff v.c.]
[-slack v.c.]
[+spread gl.]
[-const. gl.]

The lexical representations of ideophones contain obstruents that are unspecified as to the laryngeal features; these segments then receive values for the laryngeal gestures by virtue of autosegmental association with the intensive or paraintensive morpheme. The result is shown in (11), where a capital letter indicates an archisegment unspecified on the segmental tier for the laryngeal features:

(11) a. [+stiff v.c.
 [-slack v.c.]
 [-spread gl.]
 [-const. gl.]

CalKak
c'alk'ak

b. [+stiff v.c.
 [-slack v.c.]
 [+spread gl.]
 [-const. gl.]

CalKak
c^halk^hak

The representations in (11) also include cases of autosegmental spreading, where more than one obstruent in a form is associated with a single autosegmental morphological feature complex, so the morphemes composed of laryngeal features may be expressed across the board within a word.

In ideophones of the simple or morphologically unmarked class (that is, those that are neither intensive nor paraintensive), we may assume that the rule in (12) applies, spelling out remaining obstruents that are not associated with any laryngeal features as belonging to the lightly-aspirated type:

(12)

[+obst] --> [-stiff v.c.
 [-slack v.c.]
 [+spread gl.]
 [-const. gl.]] / $\frac{x}{\quad}$

The context of rule (12) requires that the affected segment be unassociated with and therefore unspecified for the requisite features. The result of this rule, which is applicable only in the simple or morphologically unmarked class, appears in (13):

(13) [-stiff v.c.
 [+slack v.c.]
 [+spread gl.]
 [-const. gl.]

CalKak
calkak

There are a few additional facts about the morphological use of laryngeal gestures in Korean ideophones that this analysis also accounts for. Martin (1962) has noted degrees of intensity in forms with more than one obstruent in syllable-initial position. Some data appear in (14):⁹

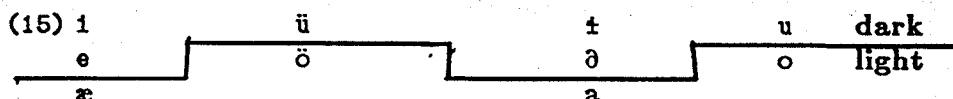
(14)

Less Intensive		More Intensive		
a.				
pancak	panc'ak	p'anc'ak		'glittering'
	p'ancak			
b.				
kancaŋ		k'anc'aŋ	k'anc ^h aŋ	'striding'
c.				
	palt'ak	p'alt'ak	p ^h alt'ak	'jerking'

A number of other scales can be found with other ideophones, but they all share the development of greater intensity as the laryngeal features are expressed on both syllable-initial obstruents or as the strong aspiration of the paraintensive is incorporated into the representation. Formally, we will say that greater intensity may appear by virtue of spreading of laryngeal features to more than one obstruent or by including both the intensive and the paraintensive morphemes in the autosegmental representation.

There is one clear case of feature-sized morphemes in the Korean ideophone system. Just as compelling are the morphologically-governed vocalic alternations and harmony found in ideophones. A considerable amount of recent literature (Clements (1980), (1981); Kiparsky (1982), Halle and Vergnaud (forthcoming)) has argued convincingly that vowel harmony systems are best represented by essentially autosegmental devices. As we will see, this claim, combined with the facts of Korean ideophones, yields an internally consistent and revealing analysis in which vowel height has a direct morphological function.

Basically, Korean ideophones divide into two classes according to their vocalism. These classes are known traditionally as light and dark, and they correspond very roughly to diminutive and augmentative respectively. The division of the Korean surface vowel system along this parameter appears in (15):



As is apparent from (15), the relatively lower vowels of any type are of the light class, characteristic of diminutives, and the higher vowels are augmentative, contradicting a widely-held universal of sound symbolism. In fact, this height distinction between light and dark vowels is apparently historically secondary (Kim-Renaud 1976, 1978), but it remains robust in the synchronic grammar of Korean.

The distribution of vowels in an ideophone is governed by a harmonic principle: dark and light vowels may not cooccur. In this respect the high unrounded vowels *i* and *ɤ* have a special status quite like that of neutral vowels in more familiar harmony systems: *i* and *ɤ* trigger dark vowel harmony when in the initial syllable, but in noninitial syllables they may cooccur with both dark and light vowels.

The examples in (16) illustrate these basic observations about the vocalism of Korean ideophones:⁹

(16)

	Dark	Light	
a.	səpə̌k kə̌ntun kə̌ntɪ̌lən kə̌c ^h icə̌k	sapak kə̌ntun kə̌ntɪ̌lən kə̌c ^h icak	'crunching' 'jumping up and down' 'wobbling' 'getting in the way'
b.	kɪ̌tɪ̌lmə̌k k'ɪ̌tə̌k k'ɪ̌n k'ɪ̌n	katɪ̌lmak k'atak k'an k'an	'almost full' 'nodding' 'sticky'
c.	pipi pit ^h ɪ̌l kisin	pə̌pə̌ pət ^h ɪ̌l kə̌sin	'twisting' 'staggering' 'listless'
d.	kəl kəl k'ecil k'ecilə̌k	kəl kəl k'əcil k'əcilak	'exhausted' 'halfheartedly' 'halfheartedly'
e.	sukun p'yulut ^h ən k'ult'ə̌k k'umcilə̌k k'umt ^h ɪ̌l	sokon p'yolot ^h ən k'olt'ak k'omcilak k'omt ^h ɪ̌l	'whispering' 'pouting' 'gulping; 'budging' 'wriggling'
f.	k'ücücü hühü nülə̌h-ta	k'öcöcö höhö nölə̌h-ta	'shabby' 'round about' 'sickly yellow'

I have arranged these forms into groups according to the vocalism of the initial syllable in the dark allomorph. There are two lexically distinct dark versions of the unrounded vowels, high and mid, mapped onto a single light low vowel (cf. (16a&b, c&d)). Vocalism of noninitial syllables, *pace* the two neutral vowels, is harmonically determined by the class of the initial syllable.

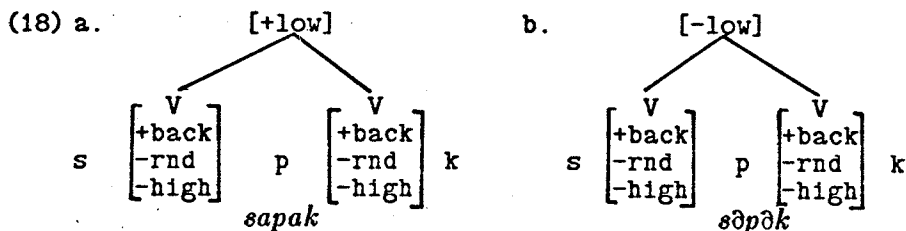
There are, then, two problems in the description of vocalism in Korean ideophones. One is the morphological status of the distinction in vowel height and the other is the concomitant process of harmony. These problems are compounded by a difficulty evident from (15): the dark and light vowel sets are not natural classes in the *SPE* feature system.¹¹ This issue is the subject of a valuable study by Kim-Renaud (1976, 1978). Kim-Renaud convincingly dismisses a number of proposals for dealing with this problem that essentially recapitulate all or part of the complex history of the Korean vowel system. Instead, she adopts the diacritic features [dark] and [light] themselves as phonetically ad hoc but semantically motivated features in Korean phonology. This gives a classification of the vowels that is derivative from the features and not phonetically primitive.

This move, if it should ultimately prove correct, is certainly compatible with the morphological framework proposed here.¹² There is, however, an alternative solution within the conventional *SPE* feature system that does not invoke objectionable synchronic processes like absolute neutralization, drag chains, and so on, nor the direct phonological use of a nonphonetic diacritic feature. It is possible to recognize a mildly abstract version of the Korean vowel system set up as in (17), with the dark/light distinction corresponding to values of the feature [low]:

(17) 1	u	ɪ	u	dark = [-low]
e		ə		
<hr/>				
æ	œ	a	ɔ	light = [+low]

A context free rule, applied subsequent to harmony or apparently any other aspect of Korean morphophonemics, will then take all [+round] vowels to [-low].¹²

Identifying the morphemes responsible for vowel alternations in Korean ideophones is now quite trivial: these morphemes are the feature values [+low] for the diminutive and [-low] for the augmentative. Vowels in the lexical segmental representations of ideophones will be unspecified for this feature (though they will be specified for [high], [back] and [round]). Vowels will receive phonological specification for [low] by autosegmental association and spreading. Representations for some simple examples appear in (18), light in (18a) and dark in (18b):



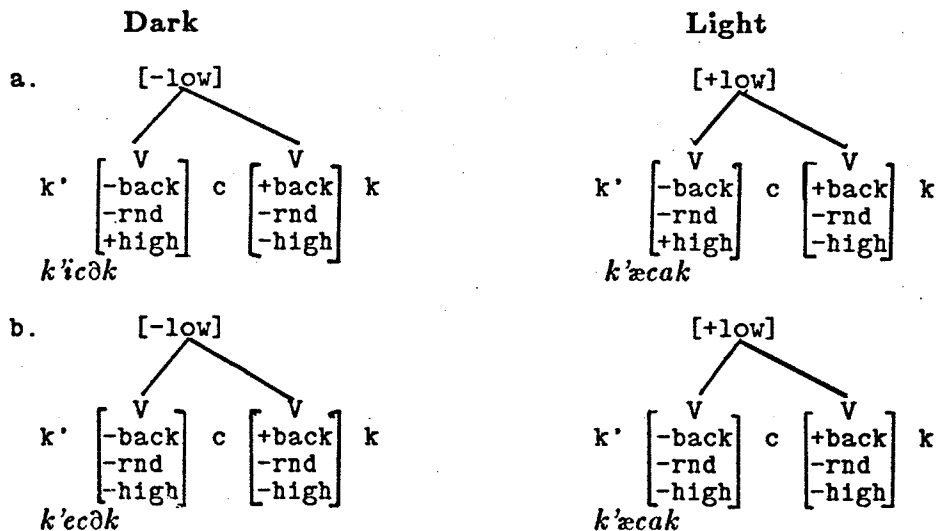
Since the feature [high] is part of the lexical representation of each vowel in an ideophone, we have potential contrasts with respect to that feature. In fact, such is the case with the unrounded vowels. The contrast between (16a) and (16b) and between (16c) and (16d) shows exactly that: the dark vowels have a lexical contrast in height that is neutralized in the light allomorphs. We can even adduce the following minimal pair with respect to this contrast:

(19)

	Dark	Light	
a.	k'icək	k'ækak	'scribbling, scratching'
b.	k'ecək	k'ækak	'halfheartedly'

We account for this behavior by having the initial vowels of (19a&b) be specified lexically for the feature [high]. However, we shall assume that autosegmental [+low], introduced as the light morpheme for ideophones, overrides an incompatible lexical specification of [high], as in (20):

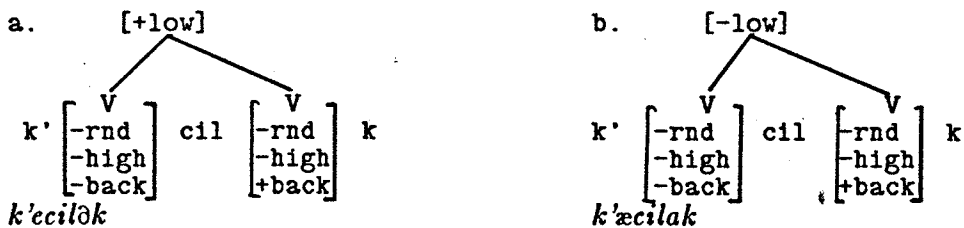
(20)



In this way we get a neutralization in the light forms of the ideophones of a contrast that exists in the dark forms. The important point about (20) is the interpretation of the initial vowel in the light form of (20a); it is æ because the autosegmental [+low] takes precedence over the segmental [+high].

Incorporating the special status of high unrounded i and ɨ into this system requires some discussion. Recall that these vowels function as dark in the initial syllable but are neutral noninitially. A quite straightforward treatment of this fact is possible by saying that these vowels are fully-specified in the segmental representation for the feature [low] when they occur in noninitial syllables, though they are unspecified for low initially, like all other vowels. The fully-specified vowels will not associate with the autosegmental feature value and will thereby remain neutral (Clements 1981; Kiparsky 1982). The representations in (21) show the special status of the high unrounded vowels in noninitial syllables, neither associating with [low] nor blocking its spread:

(21)



In summary, the analysis of the vocalism in Korean ideophones has made the following claims. First, the vowel system divides harmonically along the values of [low], and the values of this feature constitute diminutive and augmentative morphemes. Second, vowels in the lexicon are unspecified with respect to that feature, except that the high unrounded vowels are segmentally specified for it. Third, autosegmental [low] takes precedence over segmental [high]. Autosegmental spreading is thereby responsible for all the observed harmony phenomena.

Korean ideophones may have other parameters of mutation besides laryngeal gestures and vowel height. Martin (1962) classifies ideophones according to the point and manner of articulation of their final consonants, and Diffloth (1972) alludes to an extension of this treatment to medial position as well. This

parameter appears to function as a kind of classifier, marking categories like abrupt, wide, or round. The problem of identifying the semantic property correlated with the phonological one is much more severe in this case. We cannot construct obvious paradigms of the sort presented above, but there do seem to be some fairly robust generalizations (McCarthy (forthcoming)).

3.2. Echo-words in Gta?

An areal property of South Asian languages first noted, to my knowledge, by Emeneau is the formation of a class of derivatives called echo-words. Typically echo-words may be created from members of any lexical category by reduplication with some (partly) systematic change in the second copy -- that change can be consonant mutation, vocalic ablaut, tonal shift, or infixation. The South Munda language Gta? takes the ablaut option in echo-words, but with an added twist: in one class of echo-words the vowels appearing in the copy determine a semantic nuance of the whole configuration. This feature of Gta? echo-words has been described in considerable detail by Mahapatra (1976), with further confirmation by Zide (1976). In the autosegmental analysis here I have necessarily glossed over certain important details that are treated more extensively in McCarthy (1982).

The basic morphological data (Mahapatra 1976) appear in (22):

(22)	Base Form	Echo Forms
a.	kiton 'god'	katan 'being with powers equal to <i>kiton</i> (e.g., a benevolent ghost) kitin 'being smaller, weaker than <i>kiton</i> (e.g., a minor deity) kutan 'being other than <i>kiton</i> (e.g., spirits, ghosts, etc.)'
b.	kesu 'wrapper worn against cold'	kasa 'cloth equivalent to <i>kesu</i> in size and texture' kisi 'small or thin piece of cloth' kusa 'any other material usable against cold'
c.	bole 'rice'	bala 'food stuff usable as main dish (e.g., millet gruel) billi 'snacks and the like, not constituting staple food'

In (22), the form on the left is the basic word and the first member of the echo-word collocation. The forms on the right in each case are all possible second members, with the gloss referring to the meaning of the whole formation.

In general, according to Mahapatra (1976), changing all vowels in the second copy to *i* has diminutive or hypochoristic force while *a* vocalism is augmentative. The vowel pattern *u-a* means something "different from" (but related to) the meaning of the base.

As in the Classical Arabic passive, we have here a case where alternations in the identity of vowels have semantic force. There are three feature-based morphemes involved here: diminutive, augmentative, and "different from". These appear in their formal shape as autosegments in (23):

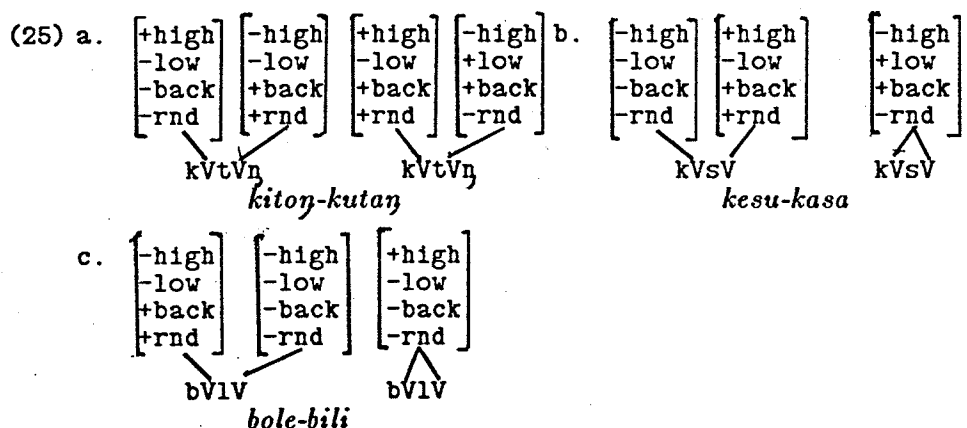
(23) Gta? Echo-word Morphemes

- a. diminutive $\begin{bmatrix} +\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix}$
- b. augmentative $\begin{bmatrix} -\text{high} \\ +\text{low} \\ +\text{back} \\ -\text{round} \end{bmatrix}$
- c. "different from" $\begin{bmatrix} +\text{high} \\ -\text{low} \\ +\text{back} \\ +\text{round} \end{bmatrix} \begin{bmatrix} -\text{high} \\ +\text{low} \\ +\text{back} \\ -\text{round} \end{bmatrix}$

The lexical representations of underived or basic forms are constructed to serve as input to echo-word formation. On the segmental tier vowels are unspecified for height, backness, and rounding. In the lexicon, however, these vowels are associated autosegmentally with the unpredictable vocalism that they bear as underived forms. Some sample lexical entries appear in (24):

- (24)
- a. $\begin{bmatrix} +\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix} \begin{bmatrix} -\text{high} \\ -\text{low} \\ +\text{back} \\ +\text{round} \end{bmatrix}$ b. $\begin{bmatrix} -\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix} \begin{bmatrix} +\text{high} \\ -\text{low} \\ +\text{back} \\ +\text{round} \end{bmatrix}$
- Vowel Feature Tier
- Segmental Tier
- $kVtV\eta$
kiton
- $kVsV$
kesu
- c. $\begin{bmatrix} -\text{high} \\ -\text{low} \\ +\text{back} \\ +\text{round} \end{bmatrix} \begin{bmatrix} -\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix}$
- $bVlV$
bole

Formation of echo-words involves copying only the information on the segmental tier and then associating one of the morphemes in (23) with the now-empty vowel slots. This association proceeds in the usual fashion found in tonal systems: a simply vocalic melody (23a, b) spreads to all available slots, while a complex one (23c) is subject to one-to-one association. Representative echo-words derived by this procedure appear in (25):

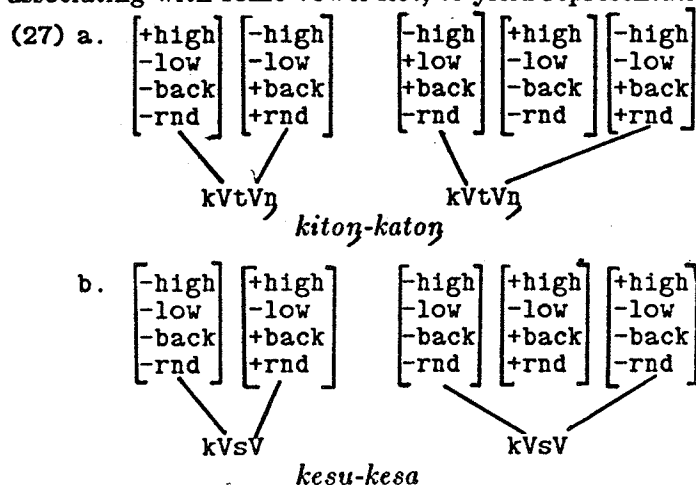


Certain additional data add to this overall conception of Gta? echo-word formation. The diminutive and augmentative melodies *i* and *a* may be associated with only some of the vowel slots of the base word - - others retain their lexical quality. This mixing of the basic and derived vocalism carries the meaning of the derived vocalism with an added pejorative force. Some examples appear in (26), corresponding to the nonpejorative echo-words in (22):

(26) Base Form Echo Forms

- a. kiton 'god' kitan/ 'being inferior in status to *kiton*
 katon (e.g., a bad ghost)'
- b. kesu kesa/ 'large piece of thick cloth, torn
 'wrapper worn kasu or worn out, serving as a kesu'
 against cold' kesu 'like kesa/kasu, but small, thin piece'
- c. bole 'rice' bale 'food not made of grain (e.g., tubers or
 mango stones)'

The interpretation of these data is as follows: the basic vocalism may be copied along with the segmental tier, and the derived vocalism appears along side this, associating with some vowel slot, to yield representations like those in (27):



The unassociated feature matrices in (27) receive no phonetic expression, just as in tonal systems (Clements and Ford 1979).

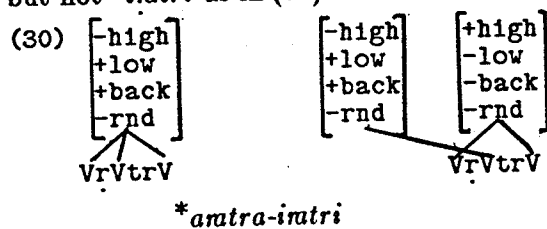
This view of partial association of the echo-word vocalism is independently supported by the facts of trisyllabic echo-words in Gta?. Trisyllabic stems form echo-words in the usual way:

(28)	Base Form	Echo Forms
a.	aratra 'up'	ir tri
b.	picori 'a bat'	pacara picir
c.	sewari 'free drink'	sawara siwiri

They may also receive partially associated melodies on one or two vowel slots, as in (29):

(29)	Base Form	Echo Forms
a.	aratra 'up'	ir tra ir tra
b.	picori 'a bat'	pacar picar pacor picar
c.	sewari 'free drink'	sawar sewar sewir

These observations are unremarkable. But what is interestingly explicitly ruled out by Mahapatra (1976) is partial association of the echo melody with nonadjacent syllables, so **imtri* or **pacom* are impossible. This follows from the usual prohibition against crossing association lines; we can get *intri*, *imtra*, *intra*, but not **imtri* as in (30):



This invocation of the prohibition against crossing association lines is exactly what we expect from an autosegmental analysis of vowel patterns in echo-words. No stipulation is needed to limit the derived vocalism to contiguous syllables; rather, this follows from an intrinsic property of the theory.

3.3. Hengxian Reduplicatives

Similar to the echo-word phenomenon is the interesting process of reduplication in the Chinese dialect of Hengxian that bears directly on the issues we have discussed here. This phenomenon has been described by Bi (1979), who indicates that Hengxian is spoken in Guangxi province between Canton and Vietnam. These facts were brought to my attention by Yuen-Mei Yin, who has provided me with a precis of the source and considerable valuable discussion of the analysis.

The Hengxian reduplication rule is applicable to adjectives, generally providing them with two degrees each of hypochoristic and pejorative meaning. For an adjective σ (that is, a monosyllable), the reduplication rule yields σ -x- σ . Our concern will be with the identity of the internal x in this construction. Some data appear in (31):¹⁴

(31)

	Base	Hypochoristic		Pejorative	
		Strong	Weak	Strong	Weak
'tender'	nun	nuk	nɔp	nat	net
'loose'	ɬuŋ	ɬuk	ɬɔp	ɬat	ɬet
'tough'	ɲuŋ	ɲuk	ɲɔt	ɲat	ɲet
'hot'	ɲit	hum	hɔm	ɬak	lek
'slippery'	wat	luk	lɔp	lat	let
'dry'	hn	huk	hɔp	hau	heu
'black'	hɔk	luk		ɲat	ɲet
'white'	pak	ɬuk		ɬai	
'yellow'	wɔn	cum	cɔm	kam	kem
'fat'	fi	ɲuk	ɲɔt	ɲat	ɲet
'thin'	cɔu	cuk	cɔp	pa	pe
'hard'	ɲaŋ	k'uk	k'ɔt	kat	ket
'tight'	kɔn	nuk	nɔt	ɬak	ɬek
'thick'	kɔt	nuk	nɔp	nat	net
'crispy'	tcui	tc'uk	tc'ɔp	tc'at	tc'et
'sticky'	nim	nuk	nɔt	nat	net
'wet'	cɔp	muk		mat	met
'sour'	ɬun	tuk	tɔp	tak	tep
'thick'	hɔu	kuk	kɔp	kat	ket

It is evident from the data in (31) that the identity of x in the frame σ -x- σ bears little relation to the identity of the reduplicated syllable. Bi (1979) notes some tenuous generalizations about the consonantism, but it would appear that the consonants are generally quite arbitrary. I shall in fact assume that the consonants are lexically selected, being an unpredictable property of each adjective, and thus our concern here will be exclusively with the vocalism.

The hypochoristic/pejorative distinction in Hengxian and the two degrees of each are expressed primarily by vowel quality (though some forms show apparently unsystematic consonant variation as well. Thus, the vowels remain fixed in the columns of the derived forms in (31), reflecting the morphological use of distinctions in vowel quality. The autosegmental morphemes responsible for the variations in vowel quality appear in (32):

(32)

Hypochoristic		Pejorative	
Strong	Weak	Strong	Weak
+high	-high	-high	-high
-low	-low	+low	-low
+back	+back	+back	-back
+round	-round	-round	-round

For any reduplicated adjective, the lexicon must provide one or more C_1VC_2 frames, where V is unspecified and therefore completely predictable while C_1 and C_2 are fully specified as the unpredictable consonantism. The vowel quality morphemes in (32) are then associated with this unspecified V of these CVC frames, yielding results like the derivatives of *ḡuḡ* 'tough' in (33):

(33)

+high	-high	-high	-high
-low	-low	+low	-low
+back	+back	+back	-back
+round	-round	-round	-round
ḡVk	ḡVt	ḡVt	ḡVt
ḡuk	ḡḡt	ḡat	ḡet

The vowel feature morphemes operate consistently to make the indicated semantic distinctions in reduplicated adjectives.

Interestingly, certain adjectives may receive only the hypochoristic or only the pejorative vocalism in their reduplicated forms. There are fairly clear semantic reasons for this limitation: some meanings tolerate only hypochoristic or pejorative modifications. A few examples of each appear in (34):

(34)

a.	Hypochoristic			
	Base	Strong	Weak	
	'new'	ḡḡn	ḡḡk	ḡḡp
	'pretty'	leḡ	luk	lḡp
	'sweet'	kḡm	ḡum	ḡḡm
b.	Pejorative			
	Base	Strong	Weak	
	'dirty'	?u	ḡak	ḡet
	'rotten'	jḡt	jat	jet
	'turbid'	tcḡk	ḡat	ḡet
	'crazy'	tin	tat	tet

It appears that we need say nothing special about the morphology of the forms in (33).

Other adjectives are reduplicated with a neutral sense, neither pejorative nor hypochoristic, recognizing only a neutral strong versus weak distinction. To this end neutral adjectives use the pejorative vocalism without the pejorative sense (35a):

(35)

	Base	Strong	Weak
'wide'	hut	lan	len
'straight'	tcik	cat	cet
'long'	tceŋ	nan	ce
'spicy'	lat	lau	leu

It would appear from the glosses that these adjectives are not readily suited to the hypochoristic/pejorative distinction.

Although this exhausts the uses to which vowel feature morphemes are put in Hengxian reduplicated adjectives, we should note that there are a few other types of reduplication where the infix syllable is specified fully by the morphology. Examples of this sort are the diminutive (36a) and augmentative (36b) of certain adjectives that seem inherently suited to such modifications:

(36)

a.	Base	Diminutive	
		Strong	Weak
'thin'	ɬai	ni	net
'shallow'	tc'in	ni	net
'short'	?ai	ni	net
'short'	tun	ni	net
b.	Base	Augmentative	
		Strong	Weak
'tall'	kɔu	ɲaŋ	
'heavy'	tcun	ɲaŋ	
'big'	tai	ɲaŋ	
'bitter'	hu	ɲaŋ	net

In these cases the infix is of the ordinary segmental sort -- fixed as to both its vowels and its consonants.

3.4. Jamaican Creole Iteratives

My final examples is of a system that is organized in several different ways within the overall autosegmental feature-as-morpheme theory. DeCamp (1974) provides an enormously detailed study of a class of forms, called iteratives, in Jamaican Creole.¹⁴ Not only did DeCamp collect and analyze every iterative actually in use by his and others' informants, but he also went to the further step of testing his analysis by presenting five informants with all of the more than 1000 formally possible but unattested iteratives (along with ca. 200 suitable controls). This remarkable achievement is therefore a very rich and unusually reliable source of morphological data.

All iteratives show total reduplication; we may take this to be a diagnostic of this form-class. Our concern, however, is not with the reduplication, which in this case is technically quite trivial, but rather with the extremely limited formal possibilities of the base for reduplication. Some sample iteratives, arranged according to form and meaning, appear in (37):

- (37) a.
- | | | |
|-------------------------|--|---|
| maka-maka 'muddy' | moko-moko 'very deep, thick mud' | meke-meke 'a thin watery layer of mud over hard clay' |
| taga-tagat 'to drag s.' | togo-togo 'to drag s. heavier than taga-tagat' | tege-tege 'to drag s. lighter than taga-tagat' |
| laga-laga 'to carry s.' | logo-logo 'to carry s. heavier than laga-laga' | lege-lege 'to carry s. lighter than laga-laga' |
- b.
- | | | |
|----------------------|--|--|
| mak-mak | mok-mok | mek-mek |
| 'less intensive than | <i>maka-maka, moko-moko, meke-meke</i> | |
| gran-gran 'firewood' | grog-grog 'big sticks' | grej-grej 'small chips or twigs as kindling' |
- c.
- | | | |
|---|-----------|-----------|
| maki-maki | moki-moki | meki-meki |
| 'familiar or jocular form of <i>maka-maka, moko-moko, meke-meke</i> ' | | |
- d.
- | | |
|-------------|---------------|
| priti-priti | 'very pretty' |
| tiki-tiki | 'fish (sp.)' |
| tuku-tuku | 'short' |

There are three basic parameters of morphologically-determined phonological variation instantiated in (37). First, we see in the columns of (37a, b, c) that choice of vocalism among the options *a, o, e* varies with the size/weight of the object or action involved. On the other hand, high vowels (37d) do not participate in this ablaut process. Second, the distinction between a disyllabic base form with nonhigh vowels (37a) and a monosyllabic base form (37b) can be one of intensity, with the longer form more intense. Third, a disyllabic form with a nonhigh vowel in the first syllable and with *i* in the second syllable (37c) is characteristic of jocose formations.

These observations absolutely limit the formal possibilities of iteratives, with a few exceptions noted by DeCamp. Our analysis, then, must recognize a number of different parameters of morphological structure and derivation in iteratives. First, iteratives are subject to a rigid constraint on canonical form: they must follow the pattern $C^*V(C(V))$, where C^* (but not the second C) is a possible onset of Jamaican Creole.¹⁵ This constraint on canonical form incorporates a number of separate exclusions. First, long vowels (which I take to be bimoraic) are not permitted in iteratives. Second, only a single consonant is possible in the intervocalic position in C^*VCV iteratives, although Jamaican Creole syllabification ordinarily countenances both hetero- and tautosyllabic clusters there. Third, C^*VC iteratives may not have final clusters, although Jamaican Creole does permit a limited set of word-final clusters. Fourth, disyllabic iteratives, perhaps the most common sort, may not have a final cluster or even a single final consonant -- they must end in a (short) vowel.

There are no independent phonological reasons for any of these restrictions on canonical form; they are observed in iteratives alone and not in words of any other type, so they obviously cannot be attributed to principles of Jamaican Creole syllabification. They hold of all iteratives, whether they are decomposable as in

(37a) or not decomposable as in (37d). They serve actually to rule out imaginable possibilities, so DeCamp notes that, e.g., **kyer fl-kyer fl* is ill-formed. I conclude that these restrictions on canonical form of iteratives must be expressed directly in Jamaican Creole morphology by the template in (38):

(38) Jamaican Creole Iterative Template

$C^*V(C(V))$, where C^* is a possible onset

Such restrictions on canonical form -- expressed as templates of C and V -- are common in the verbal and nominal systems of Classical Arabic.

A second structural parameter of iteratives is the vowel quality of the base. Choice among the nonhigh vowels *a*, *o*, *e* represents a semantic distinction in size or weight. This is indicated formally by the three vocalic feature morphemes in (39):¹⁶

(39) a. Simple

b. Augmentative

c. Diminutive

$\begin{bmatrix} -\text{high} \\ +\text{low} \\ +\text{back} \\ -\text{round} \end{bmatrix}$

$\begin{bmatrix} -\text{high} \\ -\text{low} \\ +\text{back} \\ +\text{round} \end{bmatrix}$

$\begin{bmatrix} -\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix}$

The high vowels *i* and *u* are not subject to such morphologically-governed variation; their vocalism is always lexical rather than determined by one of the morphemes in (39).

A third kind of structure in iteratives is suffixation. Iteratives with nonhigh vocalism may distinguish between a disyllabic form and a less intense monosyllabic form. This is accomplished formally by recognizing the unspecified vowel suffix in (40):

(40) Intensive

$[-\text{high}]$

Suffix V to $[C^*VC]$

Fourth, iteratives with nonhigh vocalism can have jocular forms with *i* in the second syllable. To this end, the analysis includes an additional vowel feature morpheme, this one associated autosegmentally with the unspecified vowel suffix provided by (40).

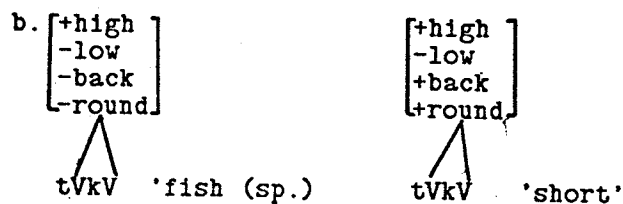
(41) Jocular

$\begin{bmatrix} +\text{high} \\ -\text{low} \\ -\text{back} \\ -\text{round} \end{bmatrix}$

\vdots
+ \check{V}

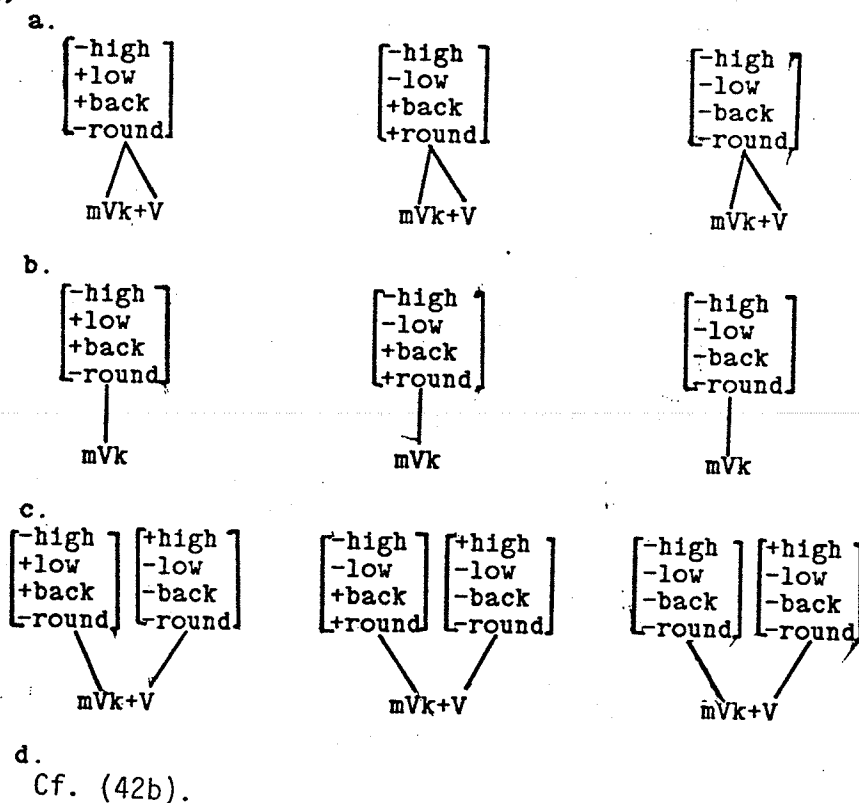
Lexical representations of iterative bases come in two sorts. Iteratives subject to the full range of morphological variation (37a, b, c) have vowels that are completely unspecified in the lexicon, like those in (42a). Iteratives with high vowels are specified autosegmentally, as in (42b):

- (42) a. mVk 'muddy'
 tVg 'drag'
 lVg 'carry'



Sample derived representations, representing the full gamut of Jamaican Creole iterative formation, appear in (43), paralleling the examples in (37):

(43)



In sum, this analysis of Jamaican Creole iteratives accounts for a number of their properties. The iteratives are subject to constraints on canonical form, expressed by the $C^*V(C(V))$ template. Iteratives may have a nonhigh first syllable and *i* in the second, a consequence of the jocular morpheme. Otherwise iteratives must have total vowel harmony. This is a result of their vowels being unspecified archisegments V and the fact that the vowel melodies are always simple (*a*, *o*, *e*, *i* or *u* above). Finally, the intensive disyllabic forms of iteratives, copying the basic vocalism, follows from the stipulation of an unspecified V suffix.

4. Conclusion

The theory presented here makes two significant departures from the usual analytic practice: morphemes may be made of feature complexes less than a full segment and the organization of words is accomplished by the formalism of autosegmental phonology. These two rather small changes in the theory have very large consequences for descriptive coverage. A whole range of otherwise intractable morphological data -- including a number of classes of phenomena where the quality of vowels or consonants is exploited morphologically -- are brought within the compass of morphological theory.

This is not to say that all the problems are solved or that everything else is insoluble. Several issues were only hinted at above: the grammatical use of vowel harmony, the nature of lexical representations, the formal character of autosegmental association. Whole classes of phenomena remain as yet unexplored in these terms, and clearly further refinement can be expected in the analysis of the phenomena discussed above. The study of questions like these promises an interesting and lively debate on the properties of this theory of nonconcatenative morphology.

Notes

¹This research was supported by the National Science Foundation under grant number BNS-8121002. I am grateful to Young-Seok Kim and Yuen-Mei Yin for their assistance.

²I have suppressed much irrelevant structure here and subsequently; for details see the cited references.

³I have made no effort here to translate Wescott's (1973) orthography to phonetic transcription.

⁴Recall that our concern here is exclusively with the formal aspect of this phenomenon, so we will have nothing to say about the functional problem presented here by the iconic (versus symbolic) use of tone.

⁵Young-Seok Kim and I have investigated the ideophone system of Southern Sotho, a near relative of Zulu described in exhaustive detail by Kunene (1965). Going from meanings to forms has yielded long lists of synonymous ideophones, yet absolutely no formal regularities are evident in these lists. This is in striking contrast to the Korean example described in the text.

⁶I am indebted to Mark Liberman for first bringing Korean ideophones to my attention and impressing me with their significance for morphological theory.

⁷Diffloth's (1972) discussion suggests that consonant quality elsewhere in the stem may have similar functions.

⁸Martin (1962) notes a single example where a vowel-initial simple form alternates with an *h*-initial intensive. Since this seems to be unique, I have not included it in (9) or subsequent discussion.

⁹Besides the facts in (14) Martin (1962) claims there is a distinction between *panc'ak* and *p'ancak*, with greater intensity in the latter case, with the modification nearer the beginning of the word. I have been unable to confirm this, however, and thus I ignore it here.

¹⁰There are some examples of ideophones showing dark/light alternations other than those in (16): *pucicik/pacicik* 'rip; fizz'; *hihi/haha/hoho* etc. 'laugh'. I assume that these sporadic cases have no bearing on the analysis of the overall

system.

¹¹This situation is not unknown in more conventional vowel harmony systems; Nez Perce is the best-known example.

¹²The implementation of Kim-Renaud's (1976, 1978) suggestion in the autosegmental framework proposed here can be briefly summarized as follows. Lexical representations would contain the unpredictable dark allomorphs of the vowels. The formation of a light ideophone would involve autosegmental association of the ad hoc phonological feature value [-dark] with all vowels of a form except for noninitial high unrounded ones (which are neutral). Finally, it would be necessary to spell out [-dark] vowels as low or mid, depending on their rounding, according to the rule in (i):

$$(1) \begin{bmatrix} +\text{syll} \\ \text{around} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix} / \begin{matrix} \text{[-dark]} \\ | \\ \text{---} \end{matrix}$$

The autosegmental spreading substitutes for the light harmony rule in Kim-Renaud's analysis.

¹³There is some independent confirmation for the underlying vowel system in (17) from other aspects of Korean morphophonemics. Kim-Renaud (1976, 1978) notes that suffix-initial schwa (ə) becomes *a* after a verb stem ending in *o* or *a*. The conditioning environment of this rule is obviously not a natural class on the surface, nor is the process itself accountable as an assimilation rule. With an underlying vowel system like that in (17), however, the nature of this alternation immediately becomes quite transparent:

$$(1) \begin{bmatrix} +\text{syll} \\ -\text{high} \\ +\text{back} \\ -\text{round} \end{bmatrix} \rightarrow [+low] / \begin{bmatrix} +\text{back} \\ +\text{low} \end{bmatrix} C_0 + \text{---}$$

Young-Seok Kim has brought to my attention two other rules of Korean phonology whose interaction with the proposed underlying vowel system in (17) bears comment. One is a rule of Umlaut that optionally fronts the back rounded vowels: *cuki* ~ *cūki* 'kill'; *noki* ~ *nōki* 'melt'. With its simplest formulation in (ii), this rule is entirely neutral between the surface and abstract analyses of Korean vocalism:

$$(11) \begin{bmatrix} +\text{syll} \\ +\text{rnd} \end{bmatrix} \rightarrow [-\text{back}] / \text{---} C_0^1$$

The second rule is an optional process of devocalization that forms a high glide out of a round vowel before heteromorphemic schwa or *a* (derived by rule (i)): *po + a* ~ *pw + a* 'see!'; *tu + ə* ~ *twə* 'place!'. Again, the simplest formulation of this rule is neutral between the surface vowel system and that in (17):

$$(111) \begin{bmatrix} +\text{back} \\ +\text{rnd} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{syll} \\ +\text{high} \end{bmatrix} / \text{---} +ə$$

It would appear that there is no phonological evidence against (17), and there is the testimony of vowel harmony and rule (i) to support it.

¹⁴Here and subsequently I have suppressed tonal information. Analysis of the tone in these constructions is impossible without an understanding, currently unavailable, of the tonal phonemes and sandhi rules of this dialect.

¹⁵These facts were first called to my attention by D. Ladyman.

¹⁶This is not precisely what DeCamp says; he writes that an iterative may begin with any sequence of a stop followed by a liquid or glide. There is only one other candidate for possible onset in Jamaican Creole, the *s*-clusters, and these seem to occur only as a result of direct English influence, so I reject them as authentic Jamaican Creole clusters and conclude that "onset" is a sufficient characterization of the initial phonotactics of an iterative.

¹⁷We could also assume that there is no simple morpheme as in (39a), and that instead there is a rule spelling out unassociated vowels in iteratives as *a*. This is more in the spirit of the analysis of laryngeal gestures in Korean ideophones --abevc.

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